Geol Survey

A guide to the geology of the Hillsdale area

Dwain Berggren

Field trip Leaflet 1980 B
May 17, 1980
Illinois Institute of Natural Resources
State Geological Survey Division
Urbana, IL 61801

Commemorating the 50th Field Trip Season and the Survey's 75th year.

COVER: In the Emerson Quarry, Stop 5, a front-end loader scoops shot rock into the conveyor that carries it up to the processing plant where it is crushed and screened to the different product sizes.

Printed by the authority of the State of Illinois/May 1980/500 copies

A guide to the geology of the Hillsdale area

Dwain Berggren

1980...75 YEARS OF SURVEY

50 YEARS OF FIELD TRIPS

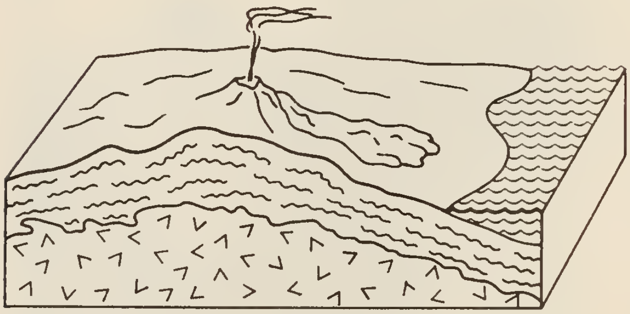
In 1930 the Geological Survey was 25 years old and the new Educational Extension Section was conducting its first field trips. Dr. M. M. Leighton, the Survey's third Chief, had created the section and its program, "...to cooperate with the science teachers of the state and furnish them information regarding geology, such as will be helpful in their teaching of earth history and the development of life."

Part of the Section's work was to start a series of six annual "earth history field trips." More than 250 teachers and layman attended the first year's trips in Dundee, La Salle-Starved Rock, Charleston-Mattoon-Effingham, Harrisburg-Shawneetown, Quincy, and Rock Island. In its 50 years (excepting the war years 1942 to 1945), Ed. Extension has conducted more than 290 field trips. In 1979, 367 people from all walks of life attended the Survey's four field trips.

Below. Teachers on the Quincy field trip, October 4, 1930, assemble in a quarry.
Right. Dr. Leighton (in the suit) and Don Carroll, the first Section Head, pose on the Peoria field trip, May 2, 1931.

THE GEOLOGIC HISTORY OF ILLINOIS

THE EARTH FORMS about 4.5 billion years ago. (If all geologic time is represented as one year, this event occurs a moment after midnight, January 1.) The age obtained by measuring radioactive elements in meteorites dates the beginning of the Earth—and Illinois. Scientists theorize that our Solar System (and the meteorites) formed when an immense cloud of dust and gas in space began to shrink and condense, dividing into bodies that became our sun and its satellites. On the Earth no rocks as old as the meteorites have been found.

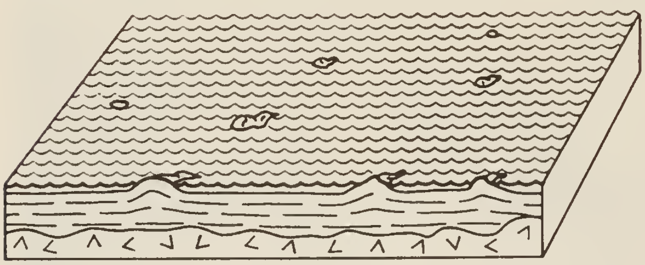


THE OLDEST ROCKS DISCOVERED IN ILLINOIS FORM about 1.4 to 1.2 billion years ago (September 8 to October 3)

Late in the Precambrian Era, molten rock from deep in the Earth squeezed up into the outer crust in the Illinois region. The rock melt solidified to become the pink granites (<L^>) that have been reached by a few deep wells in our state. The coarse grain of these rocks indicates that they cooled very slowly under a thick cover of rock, possibly under mountains.

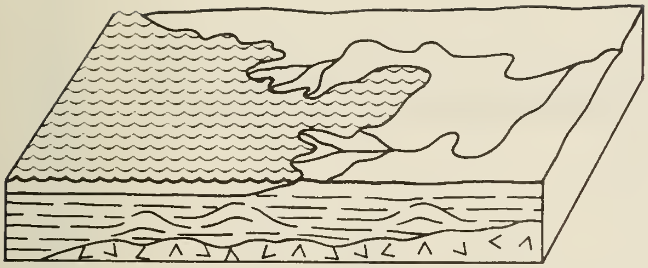
SEAS COVER THE MIDWEST about 600 million years ago (November 12)

By this time possibly 600 to 900 million years of erosion had removed the rocks covering the Precambrian granite and left it exposed in hills. Now, the Paleozoic Era began and the Earth's crust in this region sank very gradually. In general, it continued to sink—intermittently, slowly, and at different rates—until the end of the Paleozoic, 300 million years later. Mud and sand that rivers carried off the land into the shallow, tropical seas became layers of shale and sandstone. Shell sands and chalky muds that plants and animals formed in the seas became limestone and dolostone beds.



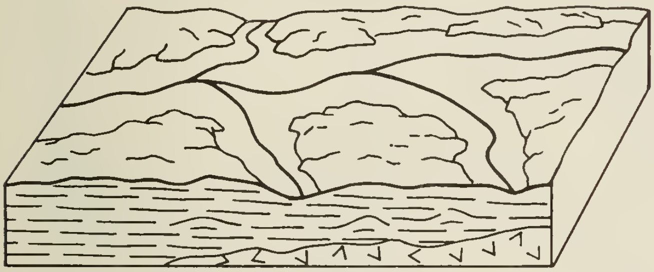
REEFS GROW IN A TROPICAL SEA about 400 million years ago (November 29)

About midway through the Paleozoic during the Silurian Period, countless generations of sea plants and animals grew in favored spots on the sea floor and built low reef platforms and mounds with their skeletons and crusts. Throughout the Paleozoic, parts of the region were warped up, eroded away, and covered again by the seas. As a result, long intervals of geologic time are not represented by rock layers. For geologists, discovering geologic history in the layers that remain is like reading a book from which most of the pages have been torn.



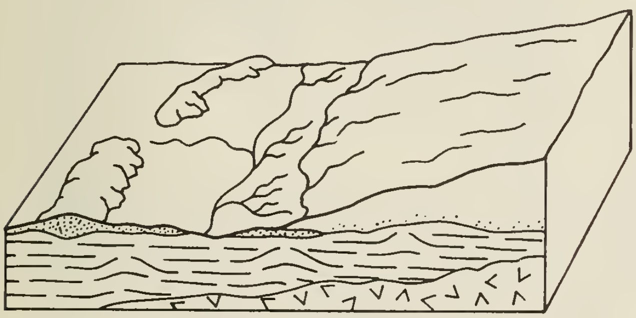
SWAMPS AND SHALLOW SEAS COVER THE REGION about 300 million years ago (December 7)

Late in the Paleozoic Era (the later Mississippian and the Pennsylvanian Periods), the Illinois region was still sinking. Large parts of it were alternately covered by very shallow seas and by swampy river deltas and floodplains lying just above sea level. Each cycle of sea and river deposition left a set of river-laid sandstones and mudstones buried under a set of marine limestone and mudstone layers. In the Pennsylvanian Period, peat beds accumulated in the dense swamp forests growing on the floodplains and were buried. These became Illinois' rich coals seams.



RIVERS WEAR AWAY THE LAND between about 280 and 2 million years ago (December 8 to 8:06 pm December 31)

Many geologists believe that early in this time a large piece of the Earth's crust began to pull apart. The fragments—or plates—gradually formed the continents of North and South America, Africa, Europe, and Antarctica. Through most of this time the Illinois region remained above sea level. Streams may have eroded as much as 5,000 feet of rock off its surface. The only sediments representing this time in Illinois are some small brown chert gravel deposits in western Illinois and a belt of Cretaceous and Tertiary sands, clays, and gravels across the southern tip of the state.



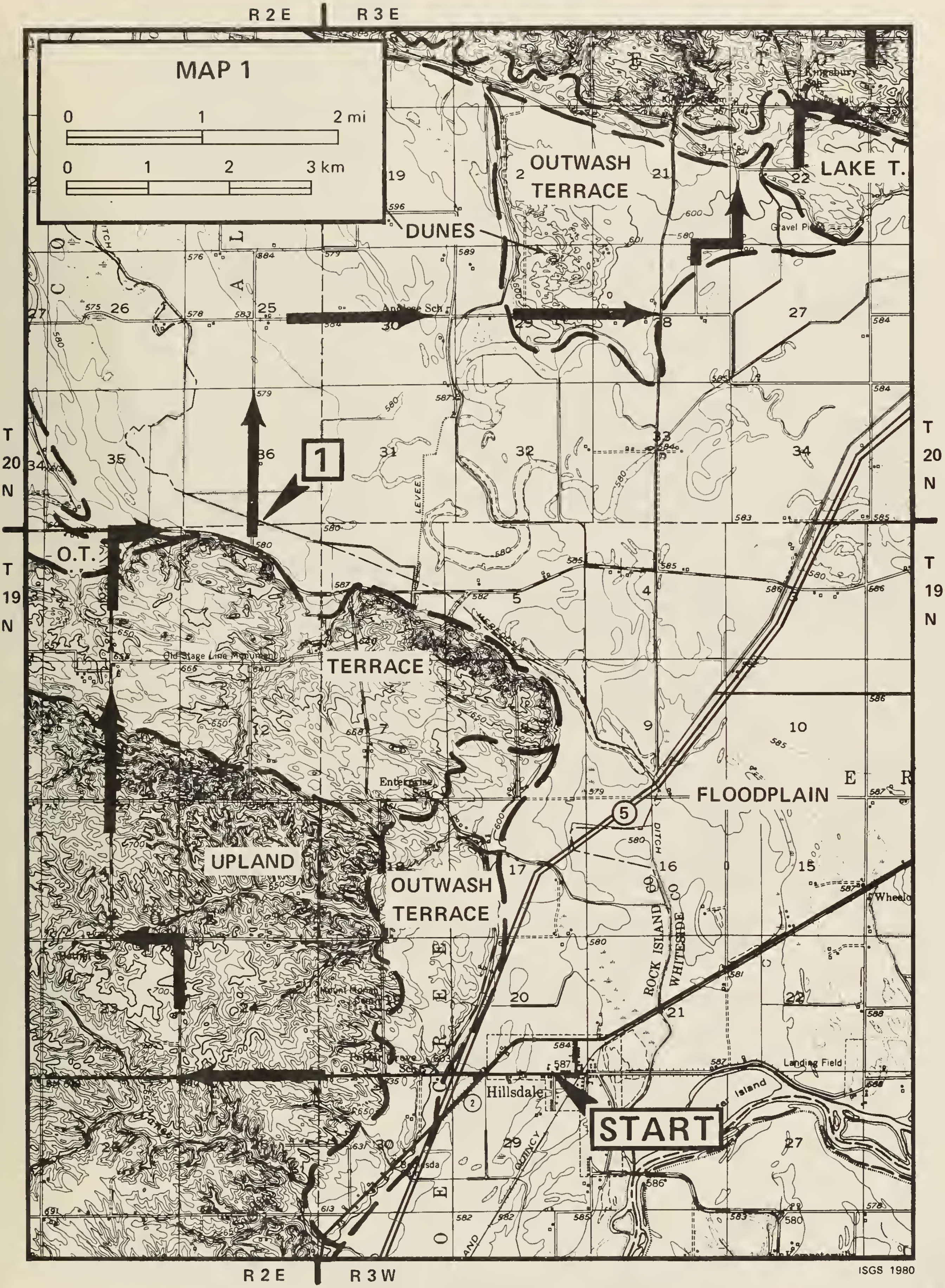
GLACIERS FLOW ACROSS ILLINOIS DURING THE PLEISTOCENE EPOCH between about 2 million years ago and the present (December 31: 8:06 pm to midnight)

Perhaps 20 to 25 times during the Pleistocene, the world climate cooled. During each of these cool intervals year-around snowfields covered Canada and northern Europe, growing thicker and becoming ice sheets. Broad ice streams—glaciers—from the Canadian ice sheets flowed southward into Illinois. Glaciers, meltwaters, and winds left mud, sand and gravel, and boulder clay over 90 percent of the state. These glacial deposits provide level, fertile soils, abundant construction materials, and water. The last glaciation ended in Illinois about 7,000 years ago; our time may be a warmer interval between glaciations.

guide to the route

Start at the entrance to the parking lot on the east side of Riverdale Junior High School in Hillsdale. The route and stop are marked on topographic maps shown on the following pages.

At mile	Go	
0.0		From the school, TURN RIGHT (west) onto Main Street.
	0.2	
0.2		The rusty, peeling boulder on the right and beside the driveway is a piece of basalt. A glacier carried it into this area after breaking it from bedrock in the Upper Peninsula of Michigan, Minnesota, or Canada, where this kind of igneous rock is found at the surface.
	0.2	
		Black, ironrich minerals make up about half of the rock. Water and air penetrating the rock change the ironrich minerals to rust. The rusting mineral grains swell and cause layers to pop off the surface of the rock.
0.4		STOP. Cross State Route 2 and GO STRAIGHT AHEAD (west).
		Before crossing the Route 2 overpass, look ahead and to the right. The land surface "steps up" sharply from the floodplain to a level surface about 20 feet higher. The step is a <u>terrace</u>. The level, higher surface—the step's tread—is what remains of a river floodplain that was 20 feet above the present floodplain of the Rock River. We will cross this terrace level several times in the field trip at mileages 7.0, 9.7, and 50.5.
	2.2	
		Crossing the highway overpass, look ahead on both sides of the road. From the terrace level we go quickly up into low, stream-lined hills. These smooth hills, which are shaped like some snow drifts and sand dunes, are called <u>paha</u>. Paha are dust dunes. These paha formed during the last glaciation as winter winds from the northwest blew dust out of the Mississippi floodplain, made barren by continual meltwater


MAP 1
0 1 2 mi
0 1 2 3 km
R2E
R3E
R3W
T 20 N
T 19 N
OUTWASH TERRACE
LAKE T.
DUNES
O.T.
TERRACE
FLOODPLAIN
UPLAND
OUTWASH TERRACE
START
1
Hillsdale
Kingsbury
Gravel Pit
Old Stage Line Monument
Enterprise Sch
LEVEE
Landing Field
ROCK ISLAND CO
WHITESIDE CO
DITCH
ISGS 1980

At mile	Go	
		flooding in the warm months. We are travelling across the Coe Upland shown on figure 1.
2.6		TURN RIGHT (north) at the T-intersection onto 284th Street North.
	2.7	
5.3		Look at the loess bank on the left at the south end of the bridge. The road has been cut down into a paha. About 8 feet of yellowish brown silt stands in near-vertical banks. Rubbing a pinch of dry loess between the fingers, one discovers that it feels like white flour. This is the "feel" of silt-sized particles.
	.2	
		Examining rain-washed surfaces one finds little white snail shells. These fragile shells are fossils of the Ice Age. The snails lived in wet places and plant-covered parts of the paha. Over thousands of years the drifting dust often buried them.
5.5		In the hillcrest north of the bridge, more loess is exposed in the road cut.
		From the hillcrest to the turn ahead, one descends to two different terrace levels. The edge of the step-down to the first and higher terrace is marked by the 700-foot contour line that crosses the road in Section 11.
	1.5	The change in the texture of the contour lines between the paha south of the contour and the terrace with its small sand dunes north of the contour is quite noticeable.
		The second step-down to the lower terrace level at the 650-foot contour line is ahead. This terrace can be seen most clearly from the 150th Avenue North intersection ahead. There, look to the left: the farm house and out buildings a quarter mile away sit on the low terrace above the lower floodplain in the Meredosia Valley.
7.0		STOP. TURN RIGHT (east) on to 150th Avenue North. (0.7 mile to farm lane)
	1.0	We are travelling along the south side of the Meredosia Channel, which is one of the valleys occupied by the Mississippi River during the Ice Age. Bedrock crops out in the bluff on the right. The rock is dolostone of the Racine Formation (Niagaran Series, Silurian System). The outcrops shown in figure 2 begin just east of the farm lane.
8.0		TURN LEFT (north) onto 291st Street North.
	0.2	
8.2		Stop 1. Park on road shoulder.

STOP

1

The Meredosia Valley. Center of the south line of Sec. 36, T. 20 N., R. 2 E., Rock Island County, Erie 15-minute Quadrangle.

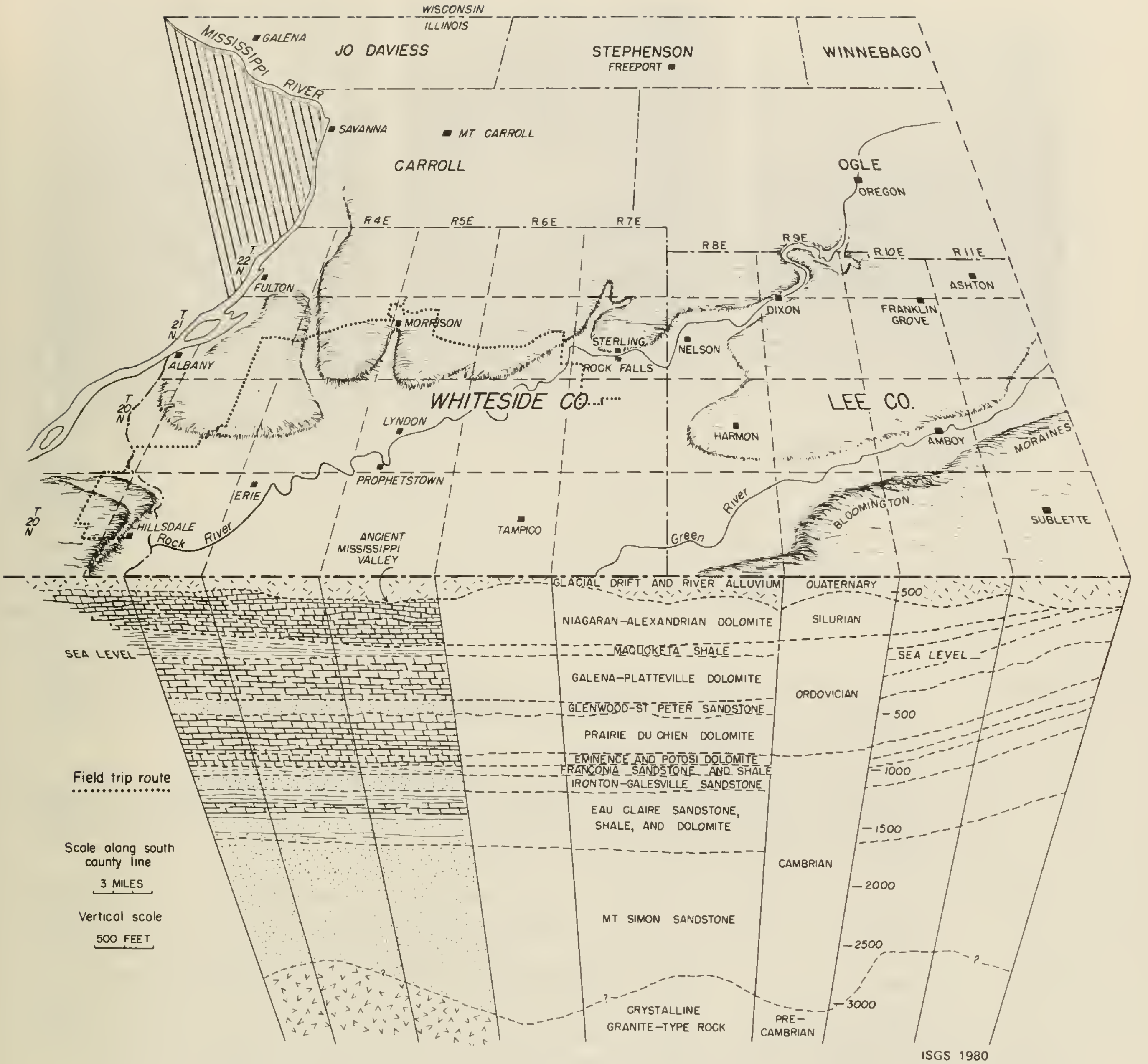


Figure 1. A block diagram illustrating the terrain and underlying bedrock units in the field trip area. (Adapted from Foster, 1956.)

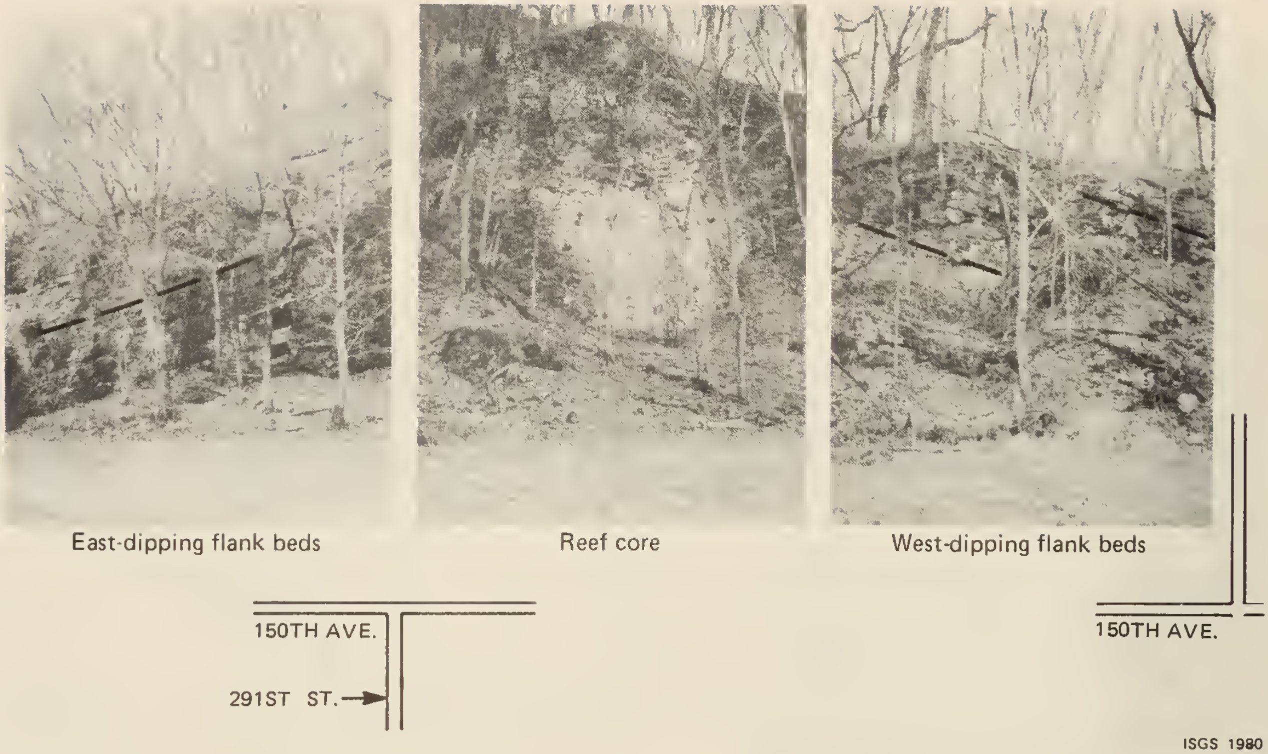


Figure 2. The core and flank beds along the side of a Silurian reef form the dolostone outcrops along the south side of 150th Avenue North near 291st Street North.

The well-bedded (distinctly layered) flank beds surround the reef core and dip away from it. The reef core is the massive (unlayered) stone that forms the oval or circular central body of the reef and may be hundreds of feet in diameter.

Countless generations of animals and plants lived here in a shallow tropical sea about 400 million years ago in the latter part of the Silurian Period. Living and dying in this favored spot on the sea floor, their skeletons and remains interlaced and cemented and heaped together, the animals and plants gradually built this mound-like structure. The sea washing the flanks of the mound worked the hard parts of the organisms living there into the dipping layers.

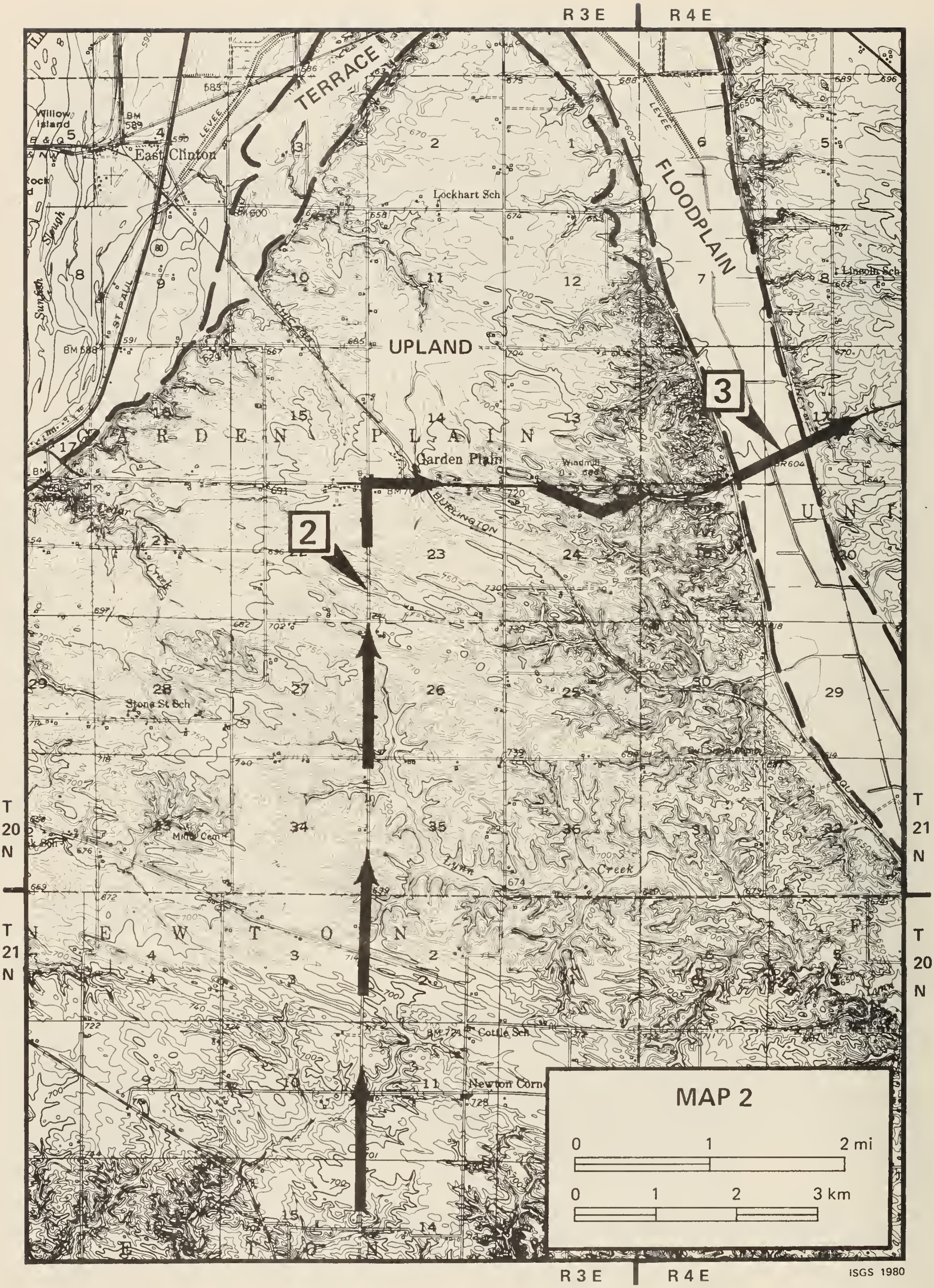
This lowland is a large river valley that lacks a large river. It is four miles wide at this point and is occupied by only one inconsequential stream flowing sluggishly in a narrow ditch. However, this little stream is a relative of its great neighbor, the Mississippi River, and both are descendents, several times removed, of a greater stream that flowed from the north through Meredosia Valley and Cattail Valley during the Pleistocene Epoch or "Ice Age."

For tens of millions of years the Illinois region has lain in the Central Lowland, the wide trough between the Rocky Mountains and the Appalachians. This lowland has drained the middle United States into the Gulf of Mexico for a very long time. The great ancestors of the Mississippi ran down the Central Lowland.

During the worldwide glaciations of the Pleistocene Epoch, which began about 2 million years ago, streams of ice—glaciers—several hundred miles wide flowed into Illinois from central and eastern Canada at different times. These glaciers entered Illinois from the northwest and northeast. The glaciers, which entered the area drained by the Mississippi's ancestors, sent floods of meltwater down the rivers. The meltwater floods cut the valleys deeper in places and partly filled them with sand and gravel in others. The glaciers advanced and blocked the old river valleys, forcing the rivers to overflow into other valleys or to cut new valleys around the glacier fronts.

The present Mississippi Valley, Meredosia Valley, and Cattail Valley are drainageways cut at different times by the Mississippi and its ancestors. When the old Mississippi River flowed through Cattail Valley and Meredosia Valley, it is thought to have flowed southeast through a now-buried valley to Hennepin to join the valley presently occupied by the Illinois River. The last glaciation to enter the area, the Wisconsinan, apparently buried this valley and diverted the river into the present Mississippi Valley.

At mile	Go	
8.2		Leave Stop 1. CONTINUE AHEAD (north).
	1.5	In the next few miles, look for tracts of sand dunes. Look for low, streamlined mounds; yellow, sandy soil; pine windbreaks planted to hold the dunes; and long sprinklers on wheels used to irrigate crops in the quickly drying soil.
		Winds formed the dunes, blowing sand off of floodplains and terraces and into drifts.
9.7		TURN RIGHT (east) onto Stropes Road.
	3.2	In the center of Section 29, 2 miles ahead, the road rises about 20 feet onto an outwash terrace and crosses a dune field. This terrace is at the same level as the low terrace west of Hillsdale.
12.9		TURN LEFT (north) onto Elston Road. Follow the road as it turns to east and north again.
	1.3	At the second turn, heading north, look ahead and to the right. Another terrace is in view. The top of this terrace is 70 to 80 feet above the Rock River. It is a remnant of the mud and sand that accumulated in glacial Lake Milan, which filled this valley for a time.
14.2		TURN RIGHT (east) onto Keeley Road.
	0.9	
15.1	0.1	STOP. Turn right (east) onto Gaulrapp Road and go 0.1 mile to Stop.


R3E
R4E
TERRACE
FLOODPLAIN
UPLAND
GARDEN PLAIN
NEWTON
East Clinton
Lockhart Sch
Garden Plain
Stone St Sch
Cottle Sch
Lincoln Sch
Lynn Creek
LEVEE
BURLINGTON
2
3
T 20 N
T 21 N
MAP 2
0 1 2 mi
0 1 2 3 km
ISGS 1980

15.2		STOP. Turn right (east) onto Albany Road.
	0.4	Notice that Albany Road runs along the edge of the hilly upland on the lake terrace.
15.6		TURN LEFT (north) onto Sand Road.
	0.6	Turn to MAP 2.
16.2		Cross Mohawk Road.
	1.0	
17.2		Cross Thome Road. (Stop 2 is 0.3 mile north of Harvey Road.)
	3.7	The contour lines on the topographic route maps outline landforms. Note that from this point on, we cross a number of paha: long narrow ridges, all aligned in the same direction. Most terrains in Illinois have been shaped by the flowing glaciers and running water. This unusual landscape was formed by wind.
20.9		Stop 2.

STOP **2**

The paha on the Garden Plain Upland. Center of the east line, SE ¼ Sec. 22, T. 21 N., R. 3 E., Whiteside County, Clinton 15-minute Quadrangle.

The paha tracts on the uplands of Rock Island and Whiteside County form a very interesting and unusual terrain. The land surface appears to billow—more than one observer has compared driving across the paha to riding a roller coaster. Similar paha tracts occur in Iowa across the river from here. In fact, paha were first described in Iowa by W. J. McGee in 1891. He used the Dakota Indian word "paha" to name these features.

Geologists have held many different theories about how the paha formed. The earlier workers, thinking that the loess was deposited by water, theorized that the paha were molded by a glacier flowing over the loess or that the paha were mud fillings in parallel tunnels through a glacier. Later workers, recognizing that the silt ridges were wind deposits, suggested that the paha were build-ups of loess between tongues of ice, or ridges left between parallel streams that eroded valleys through a thick loess blanket. Another theory suggests that strong winds blew out trenches in the loess to form the paha.

A recent study by Illinois geologists Flemal, Odom, and Vail makes certain points clear. The extraordinarily parallel, straight-sided paha on these uplands were shaped by wind. The paha are closely aligned to a N. 66°W. (WNW) line that is generally parallel to the dominant direction of winter winds from the northwest. The alignments of many sand dunes on the floodplains and terraces in this area are also related to this direction.

Core samples from holes drilled in paha by Flemal and his coworkers show that the paha are mainly drifts of Peoria Loess. The Peoria Loess was blown out of the Mississippi Valley onto these uplands (and across the state) between about 25,000 and 12,000 years ago during the Woodfordian glaciation.

What remain uncertain are the reasons that the loess formed the paha. Loess settling out of the air usually forms a blanketlike deposit that covers terrain without changing its landforms much. Flemal and the others list several possible causes. The paha loess is coarse and sandy. It might tend to form ridges rather than the typical blanket deposits of the finer-grained loess. Possibly the Silurian reef structures—the klintar that resist erosion and form mounds and hills on the land—provided windbreaks that directed the air streams so as to form paha. Finally, the authors note a suggestion by R. C. Anderson that the steep, narrow gullies in the upland sides may have channeled the dust-bearing winds up onto the upland and started the paha lines.

Whatever the case, as Anderson remarks in his Rock Island County report, "This is the only place where loess exhibits a topography of its own."

At mile	Go	
20.9		Leave Stop 2. GO STRAIGHT AHEAD (north).
	0.7	
21.6		STOP. Turn right (east) onto Garden Plain Road; go 2.7 miles to west side of Cattail Valley.
	2.7	Look to the right and left in the first mile after the turn at the paha along the road. After that distance the streams eroding the east side of the upland have changed the shape of the paha.
24.3	0.4	From the west side of Cattail Valley, go 0.4 mile to Stop 3. Notice on the map that the valley is drained by ditches and that no stream flows the valley's entire length.
24.7		STOP 3.

STOP 3

The peat in Cattail Valley. NE ¼ SW ¼ SW ¼ Sec. 17, T. 21 N., R. 4 E., Whiteside County, Clinton 15-minute Quadrangle.

The black earth showing in the ditch sides south of the road is peat. Peat is dark brown or black, partly rotted and broken plant materials that collect in the standing water of marshes, bogs, swamps, and lakes. Before Cattail Valley was drained by farmers, it was called Cattail Slough. James Shaw, a geologist working with the first Illinois Geological Survey, recorded his impressions of these wetlands when he visited them in about 1867:

> The broad, water-soaked swale...opens upon the sight, gray at the touch of October frosts, except where blackened by the sweeping march of recent prairie fires; dotted with haystacks; a creeping stream of antiseptic peat water... [shines] like a thread of silver in the shallow black ditch, opened to drain the surplus waters of the bog....

Sample the peat and tear it apart with your fingers. This is reed-sedge peat formed by grasses, sedges, bulrushes, reeds, cattails, and mosses. You won't find many recognizable pieces of these plants. Just a few stems, roots, and perhaps a seed or two. Most of the peat is humus—plant material so decayed that one cannot identify plant parts any more. Peat accumulated in the valley from about 12 to 14 thousand years ago until the farmers began to drain the slough. When the plants died and fell into the waters of the slough, microbes—fungi and bacteria—began to eat them. In stagnant water, however, the waste products, made by the microbes feeding, accumulated and finally poisoned the microbes, but preserved the plant material.

Peat harvesting. When Shaw visited Cattail Slough in 1867, he found a company in this vicinity manufacturing dry peat blocks for fuel. The company, owned by Mr. Nathaniel Dodge and a Mr. Townsend, operated two peat machines, powered by a steam engine, and made 300 tons of dry peat blocks that summer. The peat blocks sold for $7 a ton.

Dodge had begun the business in the 1850s by cutting peat blocks with a spade, drying them in the sun, and selling them for fuel to local farms and a nearby lime kiln. Shaw reports that the success of this company had stimulated a peat boom: peat lands doubled and quadrupled in price in a few months, and a second company had been organized. Shaw thought the peat was an excellent fuel, but he noted that coal from the mines near Rock Island might undersell the peat. He was right.

South of the road one sees the buildings and the high, black peat stockpile of the Anderson Peat Company. In April 1980, Mr. Marvin Geerts, the plant manager, described the peat harvesting operation to me. The peat fields are drained by parallel ditches every 80 to 150 feet. The ditches are pumped to lower the water table in the fields and make the peat dryer at the surface. A rotary hoe or disc is used to loosen a surface layer of peat, which is left to air dry. Next, an A-frame drag is pulled point first through the fields to pile the peat into two windrows. Finally, a snow blower on a farm tractor picks up the windrowed peat and blows it into a truck that carries it to the stockpile. From the stockpile the peat is loaded into the preparation plant and bagged for sale. The company sells peat for soil conditioners.

The Anderson Peat Company, founded in 1964, owns about 300 acres here and produces about 3 to 3.5 million 40-pound bags of product each year. In 1978 Illinois producted 84 million tons of peat.

The area of the Cattail Valley is about 8.6 square miles (5,500 acres) between the railroad crossing the north end and Rock Creek at the south end. Peat deposits cover almost all this area. The thickest deposits are in two areas of the valley, which total about 47 percent of the area. A 1,280-acre tract near the south end of the valley might yield 3,840,000 short tons of air-dried peat from deposits about 15 feet thick. The second to the north, might yield 3,120,000 short tons from 1,300 acres of peat an average of 12 feet thick (Hester, 1969).

At mile	Go	
24.7		Leave Stop 3. GO STRAIGHT AHEAD on Garden Plain Road.
	5.0	After leaving the valley, turn to Map 3. Once on the upland, look for paha along the road.
29.7		STOP. TURN LEFT (north) on Route 30/78, Lincoln Road.
	0.5	


MAP 3
0
1
2 mi
0
1
2
3 km
R4E
R5E
T 21 N
T 20 N
4
UPLAND
MORRISON
FLOODPLAIN
OUTWASH TERRACE
UPLAND
Prairie Center Sch
Town Hall
Green Valley Sch
Delhi Sch
Upton Sch
Richmond Sch
Langdon Sch
FENTON
OUTWASH TERRACE
TERRACE
FLOODPLAIN
UPLAND
ISGS 1980

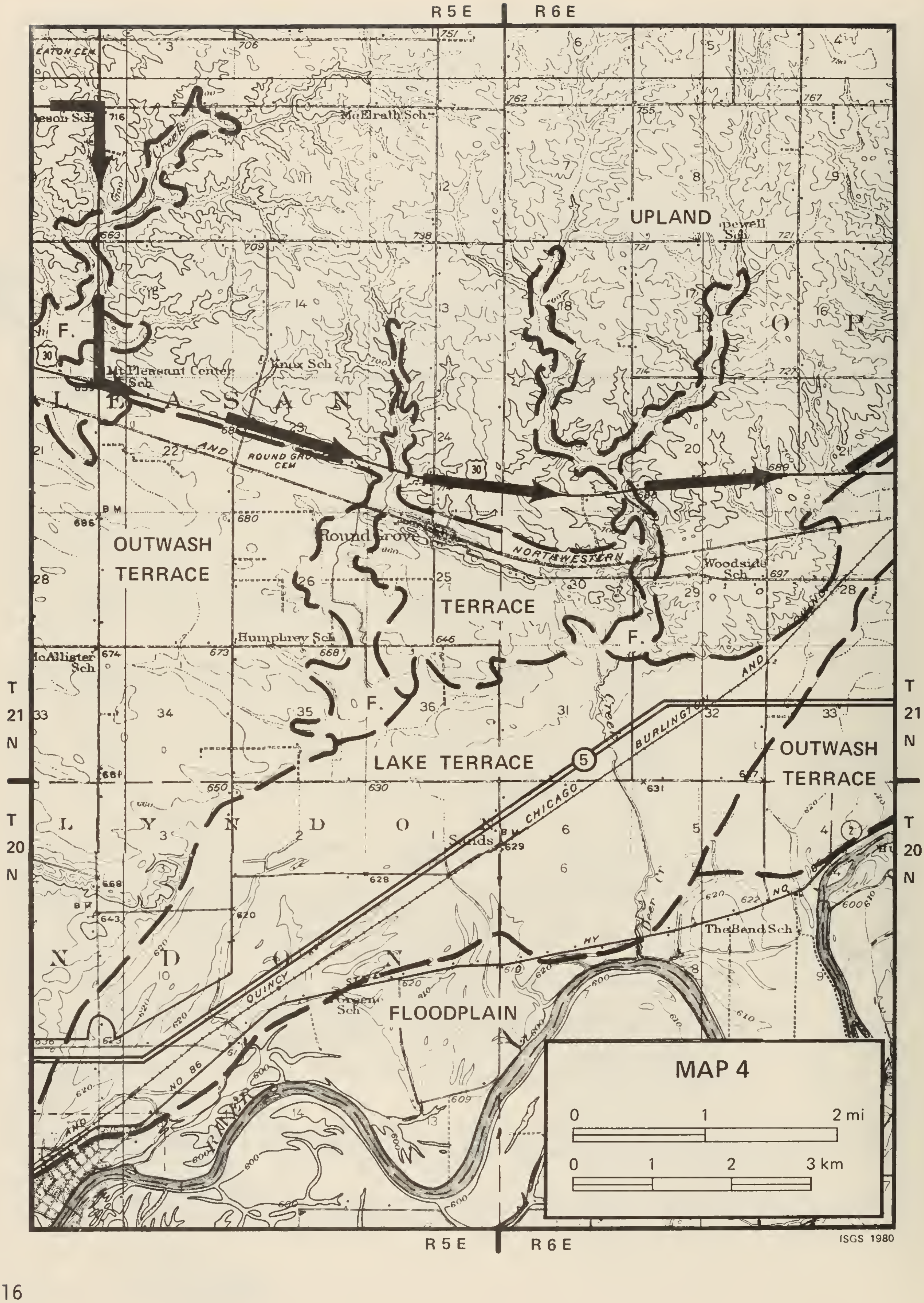
At mile	Go	
30.2		TURN RIGHT (north) onto Route 78.
	1.0	
31.2		TURN RIGHT (east) onto Damen Road.
	1.1	
32.3		STOP. TURN LEFT (north) onto Morrison-Rockwood State Park Road. The entrance to the park, Stop 4, is 0.8 mile ahead. <u>To continue field trip, begin route instructions at this intersection on Damen Road</u>.

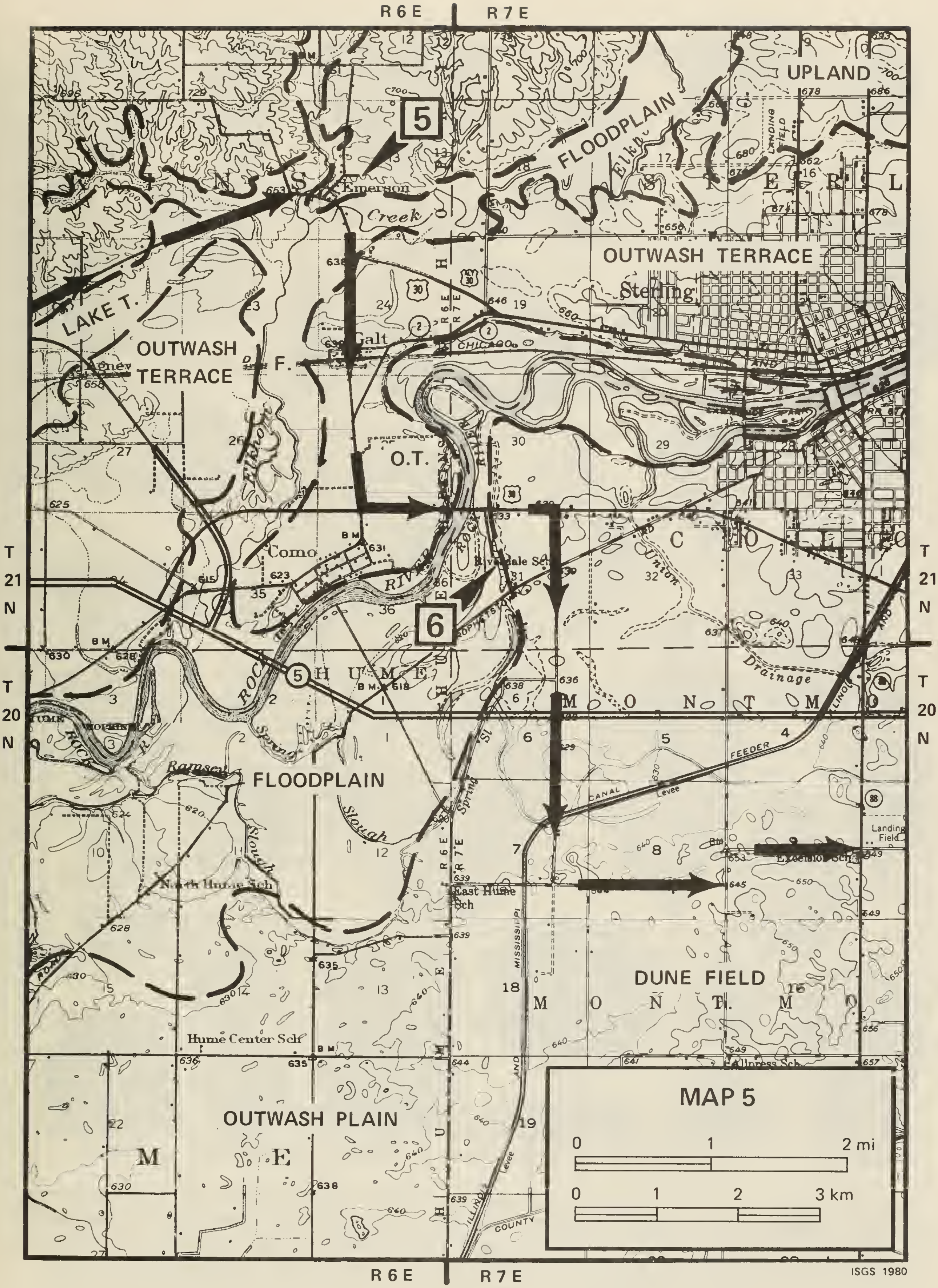
STOP 4

Lunch at Morrison-Rockwood State Park. SE ¼ NW ¼ Sec. 6, T. 21 N., R. 4 E., Whiteside County, Morrison 15-minute Quadrangle.

The park comprises 1,152 acres, much of it hardwood forest. A 77-acre lake was made by damming a branch of Rock Creek. A hiking trail on the southwest side of the lake leads to an abandoned Silurian dolostone quarry.

At mile	Go	
32.3		Leave Stop 4. At the intersection of the state park road and Damen Road, TURN LEFT (east) on Damen Road.
	0.8	The road descends into the valley of Rock Creek. From the road one can see some of the dolostone outcrops in the creek that give it its name.
33.1		CAUTION: CROSS Red Bridge and STOP at the sign at the other end. TURN LEFT (northeast) onto Norrish Road (1630 North).
	2.8	
		Turn to Map 4.
35.9		STOP. TURN RIGHT (south) onto Lyndon Road.
	2.0	
37.9		Stop. Turn left (southeast) onto Lincoln Road (U.S. Route 30).
		Notice that for several miles Lincoln Road follows the easiest terrain to travel. It skirts the rougher, stream-notched edge of the upland and is laid on the more level terrace.
	1.9	Also, compare the map contours on the upland area with those on the terrace. The closely spaced contours in root-like patterns on the upland indicate steep slopes along streams. The more widely spaced contours on the terrace and the less distinct patterns indicate a more level and poorly drained character.
39.8		On the left, opposite Round Grove Cemetery, is the entrance to the Whiteside County Sanitary Landfill.
	3.8	
43.6		CAUTION: Turn left (northeast) <u>across fast traffic</u> onto the Emerson Road.
	2.4	
		Turn to Map 5.


R5E
R6E
UPLAND
OUTWASH TERRACE
TERRACE
LAKE TERRACE
OUTWASH TERRACE
FLOODPLAIN
F.
T 21 N
T 20 N
MAP 4
0 1 2 mi
0 1 2 3 km
ISGS 1980


R6E
R7E
UPLAND
FLOODPLAIN
5
Emerson
Creek
LAKE T.
OUTWASH TERRACE
Sterling
OUTWASH
TERRACE
F.
Galt
O.T.
Como
6
Riverdale Sch
T
21
N
T
20
N
FLOODPLAIN
North Hume Sch
East Hume Sch
Excelsior Sch
DUNE FIELD
Hume Center Sch
OUTWASH PLAIN
MAP 5
0
1
2 mi
0
1
2
3 km
R6E
R7E
ISGS 1980

46.0	0.2	CROSS the creek bridge west of Emerson. Prepare to turn onto the second street past the bridge (Deets Road).
46.2	0.2	TURN LEFT (northeast) onto Deets Road. Go through town on Deets, stopping at Mill Street.
46.4	0.3	At the T-intersection, TURN RIGHT (east) onto the quarry road. CAUTION: after making the turn watch to the right for truck traffic at the Y-intersection.
46.7		STOP 5—the quarry entrance.

STOP 5

Silurian dolostone in the Emerson Quarry. SE ¼ NW ¼ Sec. 13, T. 21 N., R. 6 E., Whiteside County, Morrison 15-minute Quadrangle.

Please observe these rules during our visit to the quarry.

1. Stay away from the quarry walls—broken rock falls off them without warning.

2. Stay away from drop offs whether they are 2 feet or 40 feet off the quarry floor.

3. Stay away from quarry machinery.

4. When you hammer on rock, wear safety glasses and work where rock chips can't hit others.

Quarrying. Emerson Quarry is a surface mine, or "strip mine," typical of the smaller quarry operations in the Midwest. Soil and earth are scraped or "stripped" off the dolostone. Rows of holes are drilled into the exposed rock in certain patterns and loaded with explosives. When the explosives are detonated, the "shot" rock falls into the quarry, broken into manageable sizes. A front-end loader carries the broken rock to the conveyor which delivers it up to the processing plant. (Some of these operations are shown on the cover of this guide.) The processing plant crushes and screens the rock into the scaled particle sizes that make the different rock products sold here.

All the stone products are trucked from the quarry. Most of them are sold within a radius of a few tens of miles. The marketing regions of quarries are commonly small, mainly because within rather short distances the cost of trucking stone equals the price of the stone at a quarry. For example, a study by Survey geologist J. H. Goodwin demonstrates that on the average the cost of trucking a ton of agricultural lime more than 35 miles exceeds the $3.25 cost of a ton of agricultural lime at the quarry.

In 1978, Illinois quarries produced 62.5 million tons of stone, an amount sufficient to supply each of the more than 11 million Illinois residents with about 5.6 tons of stone apiece (Irma Samson, personal communication, 1980).

Stratigraphy. The Silurian age of the rock beds in the quarry is established by the index fossils they contain: the most conspicuous being the brachiopods *Pentamerus* and *Microcardinalia* and the corals *Favosites* and *Halysites*. (These fossils are shown on figure 3.) Other fossils divide the strata of the Silurian System into the Alexandrian and Niagaran Series. The Alexandrian Series

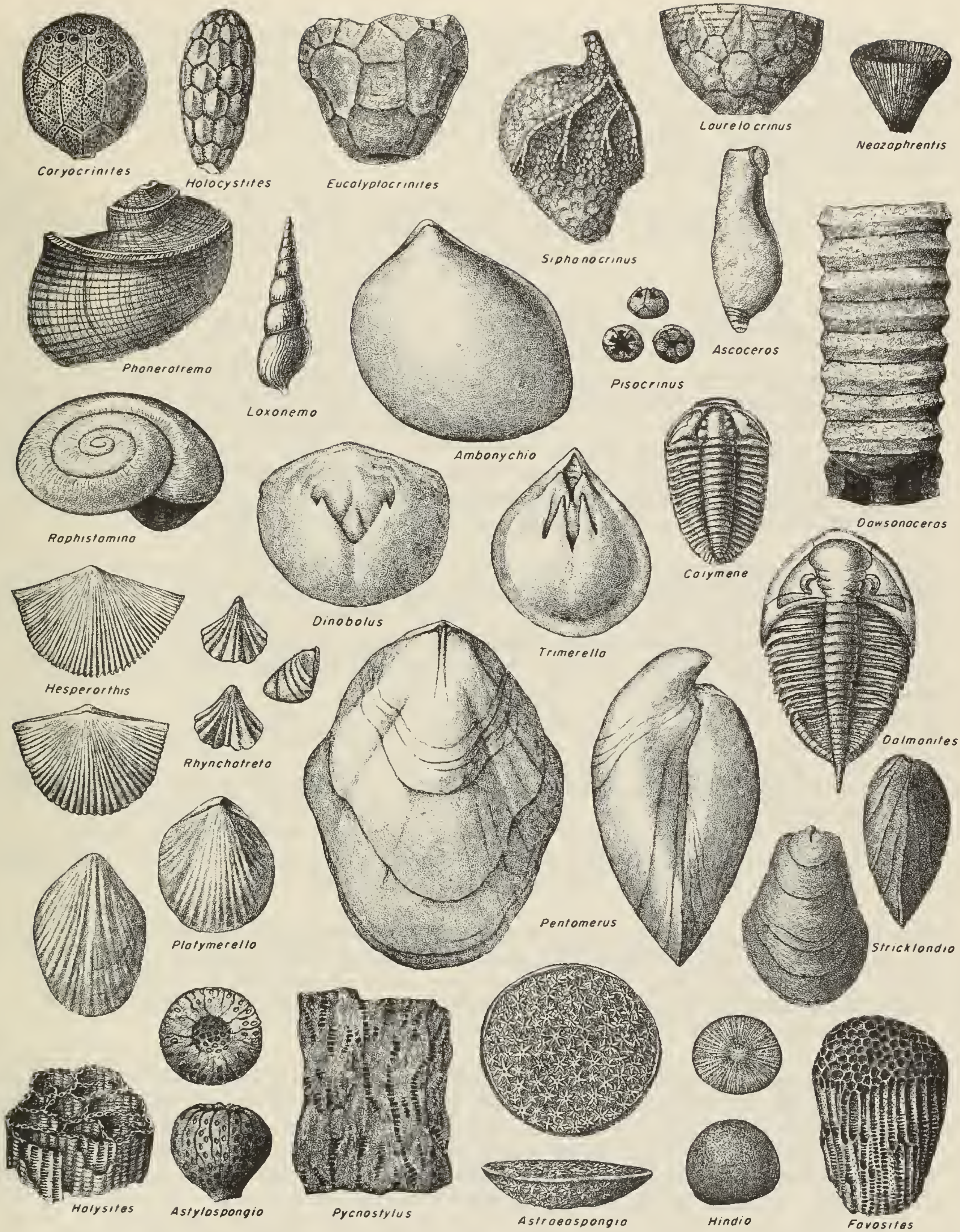


Figure 3. Representative Silurian fossils from northwestern Illinois.

is named for Alexander County, Illinois, where rocks of this division of the Silurian were first identified as this unit. The collections of strata that make up the rock units called "series" are subdivided into smaller units called formations by using differences in the physical characteristics of the rock such as color, chert content, the presence or absence of mud films, and many other characteristics.

Dr. H. B. Willman of the Survey has tentatively identified the rock strata in the quarry as the Mosalem, Blanding, and Sweeney Formations of the Alexandrian Series.

The Mosalem Formation. The quarry exposes about 15 feet of this unit in the sump below the quarry floor and probably in the lower foot or two of the quarry walls. The unit is light brownish-gray dolostone with brownish-gray mud films on partings. Its beds are even and flat-surfaced—unlike the Blanding and Sweeney Formations above it. The upper 3 feet is in 1- to 3-inch beds; the lower part is in 12- to 18-inch beds. No chert is visible, and no fossils were found in the one place examined except for black streaks vertical to the bedding, which may be burrow traces. The upper unit probably contains quartz silt because pieces of it scratch glass. This rock cannot pass soundness tests so it is not mined.

The Blanding Formation. The lower 40 feet of the quarry walls expose this light yellowish-gray dolostone unit. The top of the Blanding is a 6- to 8-inch parting which shows plainly in the older quarry sides as a rubble-filled parting that seeps water. The beds of the Blanding have irregular surfaces with light greenish-gray mud films. Silicified coral colonies are abundant, mainly *Favosites* and *Halysites*.

The upper half of the Blanding is less cherty than the lower half. The lower half contains light-gray, porcelain-like chert in knobby layers and nodule zones that are 2 to 6 inches apart and up to 4 inches thick. Chert of the same appearance occurs in the upper half of the unit but in scattered nodules and a few nodule zones. The upper half of the Blanding contains three smooth-faced, massive dolostone beds, 8 to 12 inches thick and separated from each other by several feet of the ordinary rock.

The 6- to 8-inch parting at the top of the Blanding consists of thin dolostone lenses an inch or two thick that are separated by films and layers of very light greenish-gray clay. Where this zone is exposed to weather, the clays wash out and leave a rubble-filled crack that is readily seen in the older quarry walls.

The Sweeney Formation. Erosion has worn away the top of this unit; a thickness of 35 to 45 feet is found between the bedrock surface and the parting below. The lower 10 to 12 feet of the formation, like the Blanding below, is light yellowish-gray with light greenish-gray mud films on the irregular bedding surfaces. The upper part is weathered yellowish-brown. The brown rock makes inferior products and is quarried separately.

The Sweeney, like the lower part of the Blanding, contains a great deal of light-gray, porcelain-like chert, which occurs in knobby layers and nodule zones 1 to 3 inches thick and 6 to 12 inches apart. Like the Blanding, the Sweeney has abundant silicified corals. In addition, a 6-inch thick brachiopod zone occurs about 27 feet above the base of the formation (5 to 15 feet below the surface). The layer contains a crowded mass of molds and internal casts of *Pentamerus* and *Microcardinalia*.

At mile	Go	
46.7		Leave Stop 5.
	0.2	
46.9		BEAR LEFT (south) at Y-intersection.
	0.3	
47.2		STOP. TURN LEFT (south) onto highway and cross bridge.
		After crossing the bridge, we travel across the floodplain of Elkhorn Creek. Look ahead to the left where the highway curves around the end of the hill.
	0.4	
		The hill at the curve is an outwash terrace. The top of the terrace was the floodplain of meltwater rivers running down the Rock River Valley from the glaciers melting in northern Illinois and Wisconsin.
47.6		At the highway curve, GO STRAIGHT AHEAD (south) onto Galt Road.
	0.7	Note the step in the road ahead where it goes off the floodplain onto the terrace.
48.3		STOP at street intersection in Galt. GO STRAIGHT AHEAD (south).
	0.5	
48.8		STOP. TURN RIGHT (south) onto West Lincoln Highway, State
	0.7	Route 2.
49.5		STOP. TURN LEFT (east) onto U.S. Route 30.
	1.0	
50.5		Stop 6. Just after crossing the Rock River, TURN RIGHT (south) onto the road to the Rock River Ready-Mix plant.

STOP 6

The sand and gravel pit of Rock River Ready-Mix, Inc. East half of the NW ¼ Sec. 31, T. 21 N., R. 7 E., Whiteside County, Sterling 15-minute Quadrangle.

Mining. Sand and gravel are mined at this pit by a dredge, a large pump mounted on a barge, which pumps water and sand and gravel out of the pit. In operation, the dredge intake pipe is lowered to the bottom and the 3,400-gallon-per-minute pump is started. A toothed chain rotating over the end of the intake pipe tears loose the sand and gravel. The rush of water pumped up the pipe carries the sand and gravel with it. (Rocks larger than 6 inches cannot get past the toothed chain into the pipe.) The slurry goes through the pump into the 10-inch line that carries it off the barge onto shore to the processing plant.

From the pipe the sand and gravel slurry cascades into the discharge box at the top of the plant. From the discharge box the slurry falls into the shaker screens. Over-sized rocks (larger than 1 5/8 inch in diameter) fall off the top screen into the crusher, which breaks them into product sizes.

The sand falls down through all the screens into the scalping tank. Here controlled waterflow winnows the sand into the finer "masonry sand" product and into the coarser "torpedo sand." Two conveyors carry the sand from the scalping tank to the stock piles.

Meanwhile, gravel from the screens and the jaw crusher falls into the log roller, a machine that rolls and rubs mud off the stone and cleans it. Next, the cleaned gravel falls through two screens that sort it into the 3/6-inch "pea gravel" size, the 1 1/2-inch "A rock," and the 1-inch "B rock."

This plant produces 200 to 250 thousand tons of sand and gravel each year. Torpedo sand is used mainly for concrete and fill material; masonry sand and "B" rock for concrete. Pea gravel is sold for blacktop surfacing and concrete block aggregate, and "A" rock for septic tank drainage fields. Most of the products are sold within 20 miles of the plant.

Stratigraphy. The sand and gravel mined here are part of the lower terrace—its top surface is about 20 feet above the Rock River. The deposit is covered by 3 to 5 feet of silt and is 10 to 30 feet thick. The dredged material varies from about 65 percent sand at the southern end of the pit, to about 75 percent sand at the northern end.

Outwash gravel deposits of this kind are excellent places to collect rocks. The glaciers carried rocks southward from every terrain they crossed between Illinois and Central Canada. Within minutes one can collect from the coarse gravel pile, rocks, minerals, and fossils from Canada and the states north of us.

At mile	Go	
50.5	0.4	Leave Stop 6. From the gravel pit entrance, TURN RIGHT (east) onto U.S. Route 30.
50.9	2.7	TURN RIGHT (south) on Riverdale Road. The small hills to the left are sand dunes. This part of the field trip crosses the northern corner of the Green River Lowland. The Green River Lowland is a poorly drained plain with many prominent sand ridges and dunes. It is surrounded by uplands and contains the water sheds of the Rock River (below Dixon) and the Green River. Our field trip route to Stop 5 roughly follows its northern side (figure 1). Most of it is contained in the triangle formed by the intersections of State Highways 88 and multilane 5 and Interstate 80. During the later part of the Wisconsinan glaciation, meltwater pouring down the Rock River Valley and off the front of the glacier standing just east of the lowland carried outwash—mud, sand, and gravel—into this low area and built up a wide, flat

plain. Some of the sand ridges are bars left by the meltwater floods. But many are dunes, crescent-shaped and straight.

53.6 STOP. TURN LEFT (east) onto Knief Road.

1.2 A new road just south of the stop has been cut down about 5 feet into the top of a sand dune. There are many places along the route where traffic and excavation expose the sandy soil.

54.8 TURN LEFT (north) onto Buell Road.

0.3

55.1 TURN RIGHT (east) onto Thome Road.

1.0

56.1 STOP. Route 88.

Look to the south and east. All the hills in sight are sand dunes and old, wind-blown floodplain bars. South of this intersection, Route 88 crosses 16 miles of the Green River Lowland before reaching the upland formed by the Bloomington Morainic System near New Bedford. Many sand ridges up to 50 feet high occur in this area.

END OF TRIP. Have a good, safe journey home!

BIBLIOGRAPHY

Anderson, R. C., 1967, Sand and gravel resources along the Rock River in Illinois: Illinois State Geological Survey Circular 414, 17 p.

*Anderson, R. C., 1980, Geology for planning in Rock Island County, Illinois: Illinois State Geological Survey Division Circular 510, 35 p.

Flemal, Ronald C., I. Edgar Odom, and Ronald G. Vail, 1972, Stratigraphy and origin of the paha topography of northwestern Illinois: Quaternary Research, v. 2, p. 232-243.

Foster, John W., 1956, Groundwater geology of Lee and Whiteside Counties, Illinois: Illinois State Geological Survey Report of Investigations 194, 67 p.

Goodwin, Jonathan H., 1979, A guide to selecting agricultural limestone products: Illinois State Geological Survey Illinois Mineral Note 73, 7 p.

Hester, Norman C., and J. E. Lamar, 1969, Peat and humus in Illinois: Illinois State Geological Survey Industrial Minerals Notes 37, 14 p.

Lineback, Jerry A., et al., 1979, Quaternary deposits of Illinois: Illinois State Geological Survey Geologic Map (1:500,000).

McGinnis, L. D., and P. C. Heigold, 1974, A seismic refraction survey of the Meredosia Channel area of northwestern Illinois: Illinois State Geological Survey Circular 488, 19 p.

Willman, H. B., 1973, Rock stratigraphy of the Silurian System in northeastern and northwestern Illinois: Illinois State Geological Survey Circular 479, 55 p.

Worthen, A. H., and James Shaw, 1873, Geology of Rock Island County: Geology of Illinois, v. 5, p. 217-234.

Worthen, A. H., and James Shaw, 1873, Geology of Whiteside County: Geology of Illinois, v. 5, p. 140-166.

---

*Circular not yet available for distribution.

ILLINOIS GEOLOGICAL SURVEY 75 YEARS

Geologic research and service for the citizens of Illinois since 1905